The cabbage seedpod weevil (*Ceutorhynchus obstrictus*) was introduced to North America from Europe about 70 years ago (Figure 1). The weevil was discovered in British Columbia in 1931, and from there, it dispersed south and eastward, so it now occurs throughout most of the United States.

It was first found infesting canola in southern Alberta in 1995, and since then, the weevil has spread to central Alberta and southwestern Saskatchewan. In 2000, it was found in Québec for the first time.

Host plants of the cabbage seedpod weevil all belong to the mustard family (Brassicaceae), and include canola, brown mustard, cole crops (e.g. cabbage, broccoli, cauliflower) and cruciferous weeds (e.g. wild mustard, flixweed, stinkweed).

Host plants are either "true hosts" or "food hosts." Both hosts can provide food, especially pollen, for adult feeding, but only those with large seedpods that can sustain larval development are true hosts. Examples of true hosts are canola, brown mustard, and wild mustard; examples of food hosts are flixweed, stinkweed, and hoary cress.

*Figure 1. Adult cabbage seedpod weevil on canola*

## Crop damage

*Figure 2. New generation weevil adults and feeding damage*

Crop damage from cabbage seedpod weevil can occur in several ways. When flower buds develop on canola plants, adults feed on the buds, causing bud-blasting and reduced yield potential in dry years, when the ability of plants to compensate is limited. Larvae feed within developing pods with each larva consuming about five seeds during its development. Although this amount represents only 15 to 20 per cent of the total yield of a particular pod, these pods are predisposed to premature shattering.

Larvae emerge from pods via exit holes. In humid weather, these exit holes provide an entry point for fungal infections, and additional seeds can be damaged. When new generation adults emerge in late summer, they can invade nearby fields and damage the immature pods of late-seeded canola by feeding directly on the seeds through the pod walls (Figure 2).

Because the adult is the overwintering stage of the cabbage seedpod weevil, the risk of infestation can be predicted based on the adult population of the preceding fall. High numbers of weevil adults in fall will likely mean significant infestation levels in the following spring, although a

severely cold winter with little snow cover could reduce the survival of overwintering adults.

## Life cycle

The cabbage seedpod weevil takes about eight weeks to develop from egg to adult. Development time will vary somewhat depending on weather conditions, especially temperature. There is one generation per year (Figure 3).

**Adults** – Adult weevils are ash-grey and approximately 3 to 4 mm (1/6 inch) long. They have a prominent curved snout that is typical of most weevils.

The adults overwinter beneath leaf litter in tree shelterbelts, roadside ditches, and woodlots. Late in the season (September to early November), they select overwintering sites and burrow beneath the soil surface where they are protected from low temperatures. In spring, they emerge from these sites over a period of several weeks and seek out host plants.

Adults occur most commonly on the buds and flowers of host plants, but during windy days, they move to sheltered areas within the plant canopy. Before canola crops enter the bud stage, adults can be found on wild mustard, flixweed, hoary cress, stinkweed, and volunteer canola.

When disturbed, the adults often drop to the ground and "play dead." After several seconds, they resume activity.

Mating occurs from spring to early pod development, usually on a host plant. When small pods develop, the females can deposit an egg through the pod wall onto, or adjacent to, a developing seed.

**Eggs** – Eggs are very small, oval, and opaque white. Most often, only a single egg is deposited per pod; however, two or more eggs can be laid per pod during outbreaks. Eggs hatch in about six or seven days, and females continue to lay eggs until they die later in the season.

**Larvae** – Larvae are white and grub-like, without legs or eyes (Figure 4). Soon after hatching, the larvae begin feeding within the pods on developing seeds. Larval development takes approximately six weeks, and during this time, a single larva consumes about five canola seeds. There are three larval stages (instars).

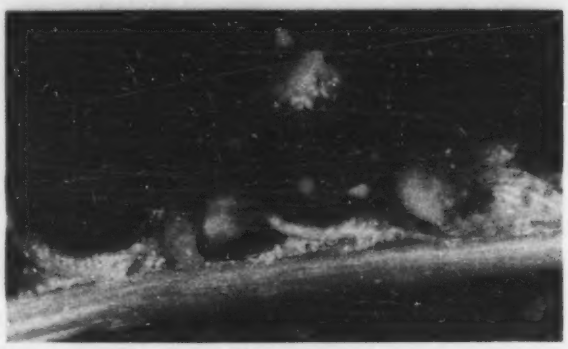

*Figure 4. Cabbage seedpod weevil larva*

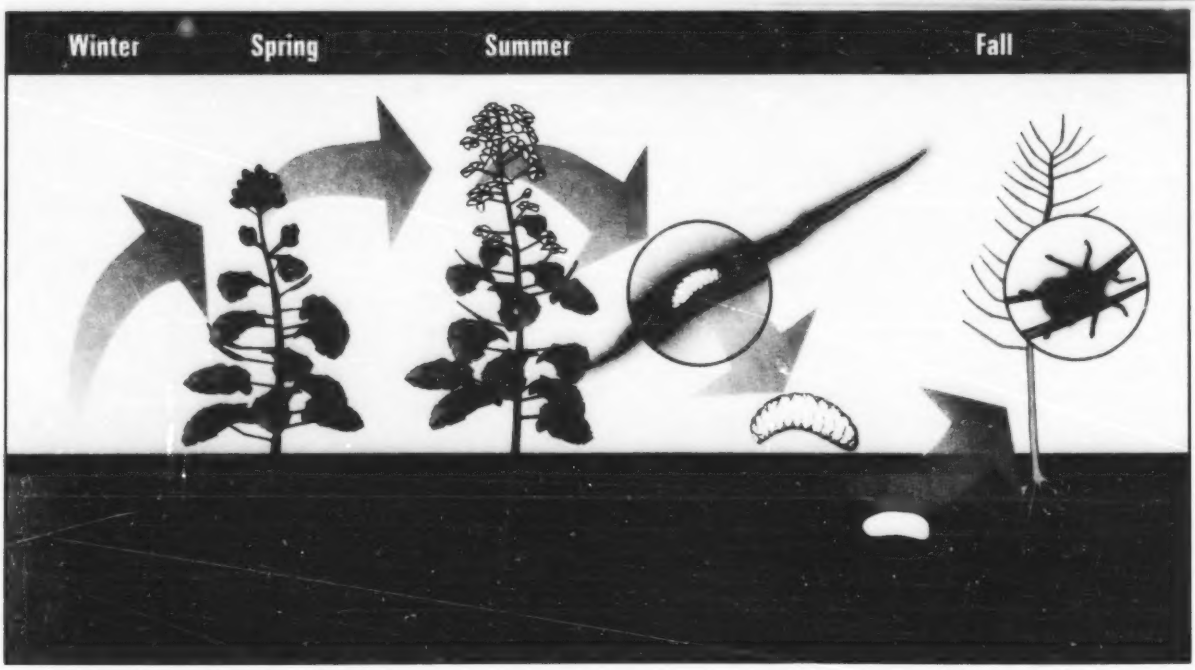


*Figure 3. The cabbage seedpod weevil life cycle*

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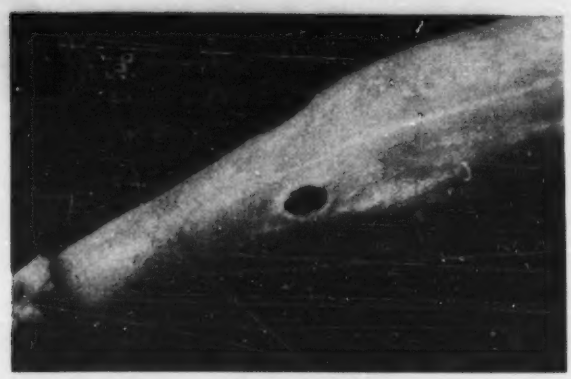
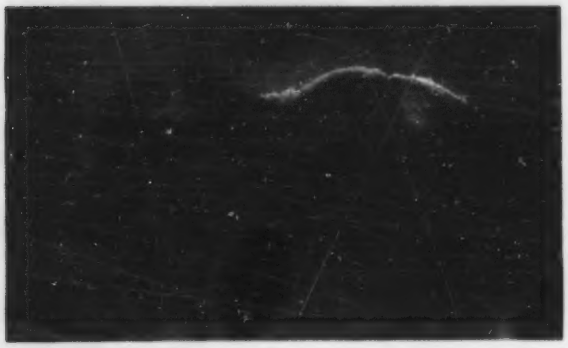


*Figure 5. Cabbage seedpod weevil exit hole*

**Pupae** – Mature larvae chew small, circular exit holes in the pod walls (Figure 5), drop to the ground, burrow in, and pupate within earthen cells (Figure 6). New generation adults emerge about 10 days later and feed on immature canola or other green cruciferous plants until late in the season when they enter overwintering sites.



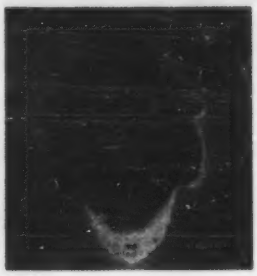


*Figure 6. Cabbage seedpod weevil pupae*

## Distribution

The distribution and abundance of the cabbage seedpod weevil have been monitored yearly in western Canada since 1997. Predictive models based largely on climate data indicate that this pest will eventually disperse to all regions of canola production in western Canada, including the Peace River region. Weevil distribution maps can be viewed at: http://res2.agr.ca/saskatoon/resres.html#ifm

## Integrated Pest Management

### Monitoring

Cabbage seedpod weevil adult abundance can be monitored by taking sweep net samples. Sampling should begin when the crop first enters the bud stage and continue through the flowering period. Select ten locations within each field, and at each location count the number of weevils from ten 180° sweeps. Sampling locations should include both the perimeter and interior of the field to obtain an accurate estimate of weevil numbers throughout the field.

This monitoring procedure will also give an indication of the number of lygus bugs present and may serve as an early warning for lygus damage, provided that the same fields are monitored into the early pod stage.

A few other weevil species may also be found occasionally in canola, but these do not require control measures. The most common of these is a closely related species, ***Ceutorhynchus neglectus,*** about one-half the size of the cabbage seedpod weevil that will feed on canola but prefers flixweed.

Canola pods harboring cabbage seedpod weevil larvae often appear distorted (Figure 7). When larvae consume some seeds within pods, the undamaged seeds enlarge and mature, often leaving misshapen pods.

*Figure 7. Normal canola pod (top) and pods distorted by internal feeding damage from cabbage seedpod weevil larvae*

### Cultural control

At present, trap cropping is the most promising cultural strategy for controlling the cabbage seedpod weevil. This approach takes advantage of the concentration of weevils that often occurs at the field edges when they first invade a canola field. By planting a trap border of early flowering *Brassica rapa* on the perimeter of the main crop of *Brassica napus*, cabbage seedpod weevils may be controlled with an insecticide applied to the perimeter before they spread throughout the field. Alternatively, a strip of the same

variety planted 7 to 10 days before the rest of the field can serve as a trap for adult weevils.

Other potential cultural control strategies being investigated by researchers include the effect of altering seeding rates, row spacings, and fertility regimes.

Although *B. napus*, *B. rapa*, and *Brassica juncea* (brown mustard) are susceptible to infestation by cabbage seedpod weevil, yellow mustard, *Sinapis alba*, is completely resistant. Yellow mustard crops will not require monitoring or control measures.

### Chemical control

No insecticides currently have full registration for cabbage seedpod weevil control. If necessary, provincial agriculture departments will ensure that legal applications of effective products are authorized through the emergency registration process.

Chemical control is recommended when an average of three to four adult weevils are collected per sweep, following the monitoring guidelines above. If control is required, the best time to spray is when crops are in 10 to 20 per cent flower to avoid egg laying in newly formed pods. This is the stage when 70 per cent of plants in the field have at least 3 to 10 open flowers. Spraying should be done late in the day to minimize harmful effects to beneficial insects in the crop, especially bees. Always consult the product label for appropriate rates and application guidelines.

### Biological control

Predators, parasites, and diseases are important in regulating insect pest populations. To date, the impact of biological control agents on cabbage seedpod weevil populations in western Canada has been minimal.

In Europe and the United States, parasitic wasps are effective for reducing both adult and larval weevil populations (Figure 8). The most important species are *Microctonus melanopus*, a wasp that parasitizes adult weevils, and *Trichomalis perfectus*, a wasp that attacks weevil larvae within the pods.

*Figure 8. Parasitic wasp of cabbage seedpod weevil adults*

Research in 1998 and 1999 found that weevil populations in southern Alberta were non-parasitized, but some evidence of parasitism was found in 2000. A major focus of work in the future will be to enhance the abundance and dispersal of these parasites, thereby reducing the need for insecticide use.

## Contact information

Producers, agrologists, and landowners with an interest in obtaining additional information on the biology and control of cabbage seedpod weevil can contact:

- local provincial government crop specialists or extension agrologists
- Dr. Lloyd Dosdall, Alberta Agriculture, Food and Rural Development (Edmonton) (780-422-4911)
- Mr. Doug Moisey, Canola Council of Canada (Fort MacLeod) (403-553-2829)
- Dr. Héctor Cárcamo, Agriculture and Agri-Food Canada (Lethbridge) (403-317-2247)
- Mr. Rob Dunn, Alberta Agriculture, Food and Rural Development (Lethbridge) (403-381-5237)
- Mr. Scott Hartley, Saskatchewan Agriculture and Food (Regina) (306-787-4669)
- Dr. Owen Olfert, Agriculture and Agri-Food Canada (Saskatoon) (306-956-7288)
- Ms Lori-Ann Kaminski, Agriculture and Agri-Food Canada (Saskatoon) (306-956-7669)
- Mr. Jim Bessel, Canola Council of Canada (Saskatoon) (306-373-6771)
- Dr. John Gavloski, Manitoba Agriculture and Food (Carman) (204-745-5668)

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